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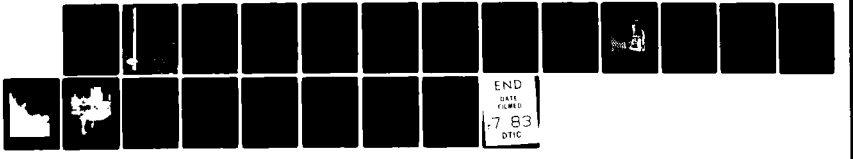

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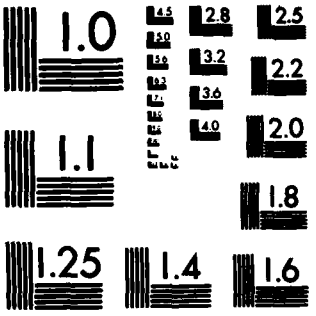

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Report 2371

MT75 WIRE ROPE TESTER

by

Kathleen S. Chapman

November 1982

U.S. ARMY MOBILITY EQUIPMENT
RESEARCH AND DEVELOPMENT COMMAND
FORT BELVOIR, VIRGINIA

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Report summarizes the ability of the MT75 Rope Tester to detect wire rope defects both externally and internally. The test instrument performed well in its ability to detect defects purposely inplanted into test wire rope samples. However, in an actual field test inspecting a crane wire rope, the tester identified no defects not detected visually by the operator.

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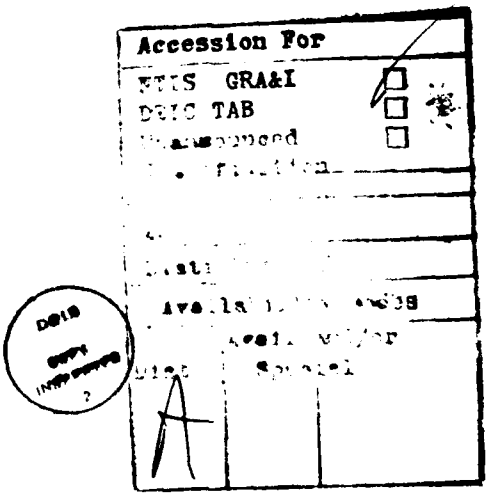

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in.	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
$in.^2$	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	*ha*
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric ton	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
$in.^3$	cubic inches	16	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	degrees Fahrenheit	5.9 (after subtracting 32)	degrees Celsius	°C

Approximate Conversions
from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in.
cm	centimeters	0.4	inches	in.
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	$in.^2$
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
ml	milliliters	0.06	cubic inches	$in.^3$
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

MT75 WIRE ROPE TESTER

I. INTRODUCTION

1. **Background.** The US Army uses wire rope in many applications, such as slings, cranes, and hoists. Daily and periodic inspection as well as testing are performed in accordance with Technical Bulletin TB 43-0142, "Safety Inspection and Testing of Lifting Devices." Wire rope inspection is presently accomplished visually. Only the external part of the wire rope can be inspected for breaks, corrosion, and abrasion. Nondestructive internal inspection is visually impossible. The Army has expressed a need for internal and external inspection capabilities. On 15 May 1980 NDT Technologies, Inc. submitted an unsolicited proposal for a new wire rope test instrument for military application to the Army Advanced Concept Team. The proposal was forwarded to MERADCOM, and the Mechanical and Construction Equipment Laboratory reviewed the proposal and procured an MT75 Rope Tester for testing and evaluation.

2. **Description of Test Instrument.** The MT75 Rope Tester (Figure 1) consists of the following items:

One test assembly.

One headphone set.

Two hinged sensor heads.

Eight rope guides (two each, 3/8-inch, 1/2-inch, 5/8-inch, 3/4-inch).

Two battery chargers.

One operation and maintenance manual.

One carry case.

The wire rope is magnetically saturated when placed in the hinged sensors. Where an inhomogeneity (tear; cut; break; abrasion; corrosion) is present, a distortion in the magnetic flux results, causing leakage flux. This leakage flux creates a signal indicating an inhomogeneity. The signal is displayed aurally by headphones or visually by a recorder.

3. **Purpose and Scope.** The purpose of this test was to determine the feasibility of using the MT75 Rope Tester to inspect wire rope. The equipment was tested to a specific test plan. The appendix to this report contains a copy of the test plan. Testing was conducted at MERADCOM's North Annex Test Area from 3 February to 10 February 1982.

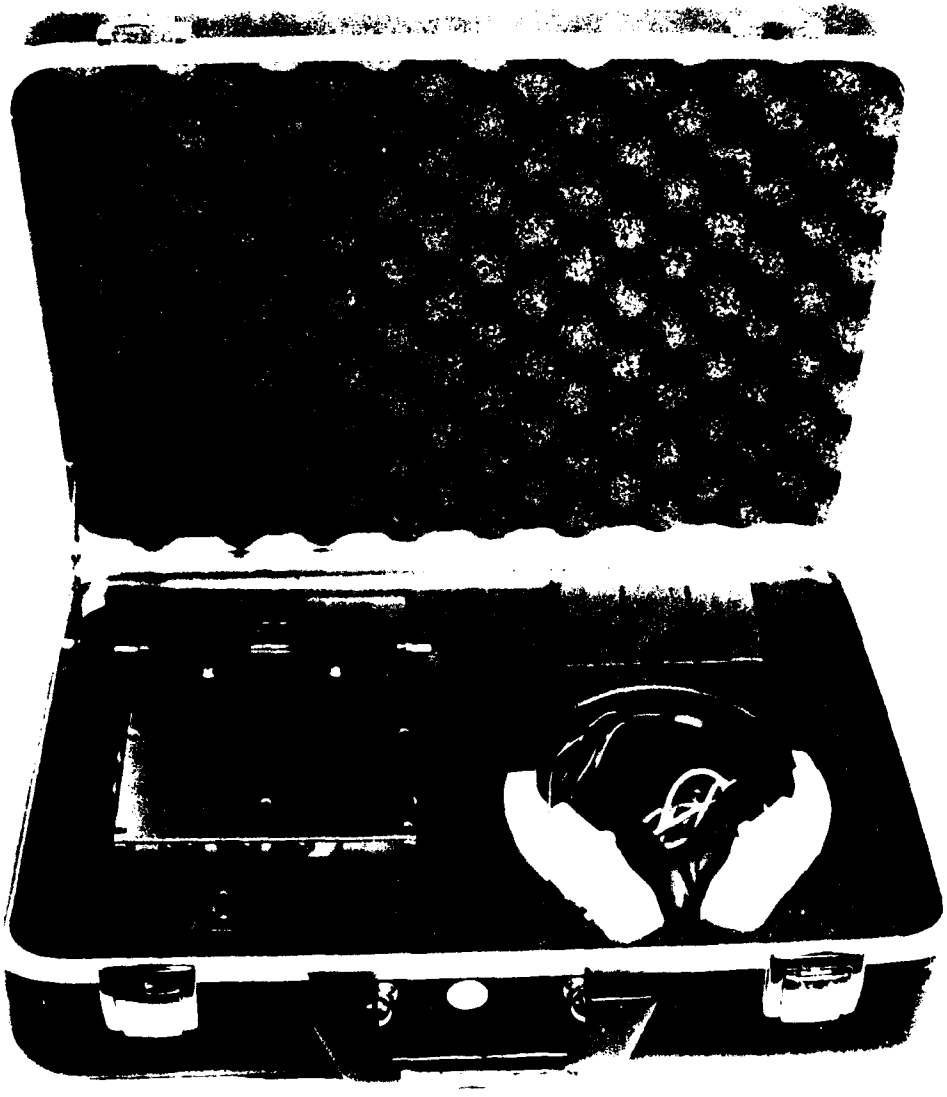

Figure 1. The MT75 rope tester.

II. TEST AND TEST RESULTS

4. **Test Samples.** Wire rope samples of varying diameters from 3/8 inch to 3/4 inch were prepared by personnel from the Product Assurance and Testing Directorate as specified in the test plan. A new wire rope was used as a reference cable. Breaks, cuts, filed notches, and flattened areas were applied. A wire rope with breaks and tears was encased in electrical insulating tape; another was partially repaired with solder on areas which were cut. The table shows the prepared wire rope samples.

5. **Tests.** Wire rope samples were tested by a technician. After each sample was tested, the MT75 Rope Tester was checked for accuracy with reference wire rope No. 2. Each wire rope was tested a minimum of two times.

6. **Test Results.** A continuous signal heard through the headphones of the MT75 Rope Tester indicated a wire rope with no flaws. A clicking signal was heard when a break in the wire rope passed through the hinged sensors. A different signal was heard through the headphones when a flaw other than a break was present.

7. **Discussion of Test Results.**

a. Wire rope No. 3 which was torn or broken every 5 inches relayed a signal which indicated a broken wire every 5 inches. Wire rope No. 6 also contained breaks and tears but was encased in electrical insulating tape. It relayed a signal indicating broken wires.

b. Wire rope No. 4 was partially repaired with solder after it had been cut to varying depths. The wire rope relayed a signal indicating broken wires regardless of the solder repairs.

c. Wire rope No. 5 which was filed and wire rope No. 7 which was flattened with a hammer both relayed signals indicating flaws. The signal indicated a defect other than a break each time a defect passed through the hinged sensors.

d. False signals were observed during testing. No defects were observed. The false signal was attributed to the opening and closing of the hinged sensors.

e. The used wire rope (No. 1) was in a deteriorated condition, with several breaks, tears, and rusty areas. The condition of the wire rope was too poor for it to be used in any application. A constant static signal heard through the headphones made it impossible to detect breaks.

Prepared Wire Rope Samples

Wire Rope Reference Number	Wire Rope Preparation	Rope Diameter (in.)	Classification	Core	Lay
1	Used	1/2	6x25	IWRC*	Right Lay, Regular Lay
2	Untouched	1/2	6x25	IWRC	Right Lay, Regular Lay
3	Tears and breaks every 5 in. on all sides	3/4	6x19	IWRC	Right Lay, Regular Lay
4	Cuts of varying depths; soldered	1/2	6x25	IWRC	Right Lay, Regular Lay
5	Filed	5/8	6x19	IWRC	Right Lay, Regular Lay
6	Tears and breaks encased in insulating electrical tape	3/8	6x19	IWRC	Right Lay, Regular Lay
7	Flattened	3/8	6x19	IWRC	Right Lay, Regular Lay

* Independent Wire Rope Core

f. During testing, the audio signal was intermittent due to a loose headphone connection. When continuity was re-established the test was repeated to assure accuracy of the test results.

g. The MT75 Rope Tester was tested on the 1/2-inch-diameter cable of a Grove 25-ton Hydraulic Truck-Mounted Crane Model TMS 300-5. The crane cable was inspected visually for defects. The defects, which were flattened areas, were marked with spray paint (Figure 2). The cable was then inspected with the MT75 Rope Tester (Figure 3). A signal indicating defects other than breaks was heard each time a marked area passed through the hinged sensor. No additional defects were detected.

h. A partial repair with solder, a smashed area, or a frayed area changes the outer shape of the wire rope. These changes sometimes caused the hinged sensors to open due to the close tolerance of the hinged sensors and to the inability of the wire rope to pass through the hinged sensors.

i. Difficulty was encountered in manually handling the MT75 Rope Tester when testing the crane cable. As the speed of the cable increased through the MT75 Rope Tester, it became more difficult to keep the tester from traveling with the cable.

III. CONCLUSIONS

8. It is concluded that:

a. The ability of the MT75 Rope Tester to detect a break, tear, or cut is not affected by the depth of the defect. Cuts ranged from depths of 1/32 inch to 1/8 inch.

b. A partial repair of a wire rope with solder does not affect the ability of the MT75 Rope Tester to detect a defect.

c. Abrasions, such as filed areas, are detected by the MT75 Rope Tester.

d. A covering such as a rubber housing does not affect the ability of the MT75 Rope Tester to detect a defect within a wire rope.

e. Flattened areas are detected by the MT75 Rope Tester.

f. The crane operator was able to visually identify every defect detected by the MT75 Rope Tester.

g. The MT75 Rope Tester did not detect any defects other than those which were intentionally made or were marked.

Figure 2. The defects are marked with spray paint.

Figure 3. Cable being inspected with the MT75 rope tester.

APPENDIX

TEST PLAN FOR WIRE ROPE ANALYZER

1. **Test Apparatus:**

(a) One MT75 Wire Rope Test Instrument.

(b) Six new wire rope cables, 5 feet in length, having varying diameters up to and including 3/4 inch.

(c) One used wire rope cable, 10 feet in length, having a diameter of 3/4 inch or less. Cable should contain some bends and breaks. Cable with rusty covering is desired.

2. **Test Procedure:**

(a) Preparation of Cables.

(1) Inspect all new cables to be sure they are free of tears, cuts, and breaks. Inspection should be accomplished through visual inspection and with the aid of the MT75 analyzer. Determine the number of defects in the used cable.

(2) One cable is to be left untouched. This cable will be used as a reference cable.

(3) Take one cable and make tears or breaks along the cable's surface. Tears and breaks are to be made every 5 inches along the cable. Tears and breaks shall be made on all sides of the cable.

(4) Take one cable and make several cuts of varying depths. The cable shall be completely severed in at least one place. Solder shall be used to patch all cut areas of the cable. Solder shall be applied only to the outer surface areas of the cable.

(5) Take one cable and file several notches along the cable such that wire strands are marked but not torn or broken.

(6) Take one cable, having a diameter of less than 3/4 inch, and make tears and breaks along the cable's surface. Encase the cable in a rubber housing.

(7) Take one cable and compress or flatten it in several spots along the length of the cable.

(b) Test.

(1) Use the analyzer to check cable (a)(3) above. Objective of this test is to determine if the analyzer has the capability to pick out every tear and break in the cable.

(2) Use the analyzer to check cable (a)(4) above. Objective of this test is to determine if a cable that is partially repaired can be detected by the analyzer.

(3) Use the analyzer to check cable (a)(5) above. Objective of this test is to determine whether the analyzer will detect damage to a wire cable that is not actually damaged.

(4) Use the analyzer to check cable (a)(6) above. Objective of this test is to determine if the analyzer can detect defects in the cable through the rubber housing.

(5) Use the analyzer to check cable (a)(7) above. Objective of this test is to determine what effects deformations in the cable will have on the analyzer ability to detect flaws.

(6) Use the analyzer to check the used wire cable. Objective of this test is to determine if the analyzer can detect defects in used cables. Test will also demonstrate whether spots of rust have any effect on the analyzer's detection capabilities.

(7) After each test, the analyzer shall be checked out with the reference cable.

(8) Cables shall be prepared by one technician and tested by a second technician.

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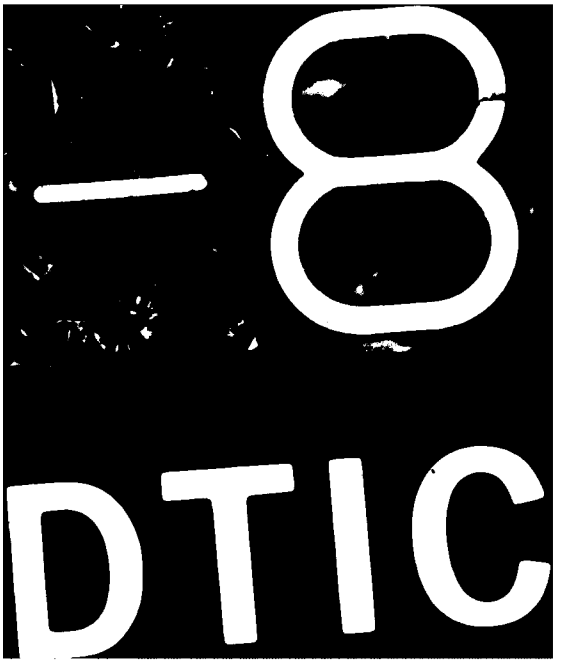
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